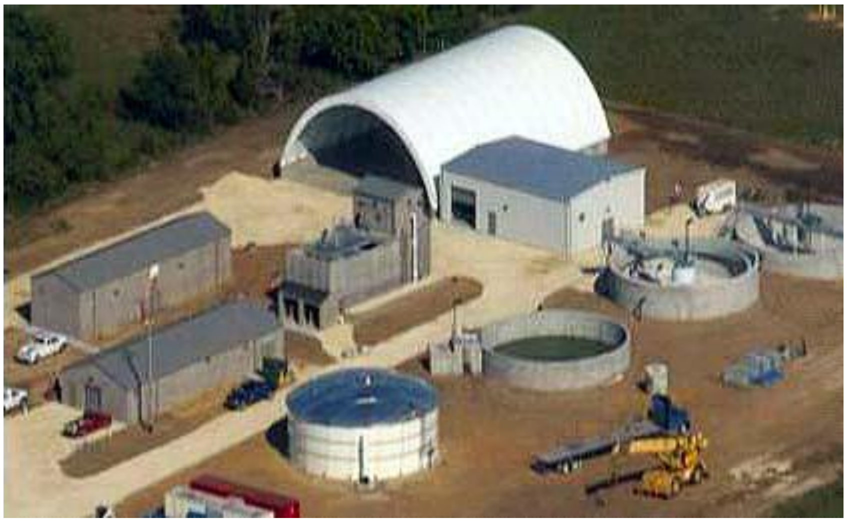
Wichita Area Future Water Supply: A Model Program for Other Municipalities



The City of Wichita's Equus Beds Aquifer Storage and Recovery (ASR) project is one aspect of the City's plan to ensure that Wichita has the water it needs through the year 2050 and beyond. The project is a model for water supply efforts across the nation and the globe. It has attracted visitors from Australia, India, Bangladesh, Nepal, China and several other global communities.

BACKGROUND

Boundaries: The Equus Beds Aquifer has been a major source of water for the City since 1940. The aquifer covers portions of Sedgwick, Harvey, McPherson and Reno counties. The aquifer encompasses approximately 900,000 acres, and withdrawals from the aquifer average 157,000 acre-feet annually. The consumers of the aquifer are:

- Irrigators (55 percent)
- Municipalities: Wichita, Halstead, Newton, Hutchinson, McPherson, Valley Center, and others (39 percent)
- Industry (6 percent).

Threats and Fears: Since the 1950s, water levels in the aquifer have dropped up to 40 feet because water rights and pumpage have exceeded the aquifer's natural recharge rate of six inches per year. Because of this over usage, the Equus Beds aquifer is being threatened by saltwater from the Arkansas River to the southwest, and by oilfield brine from the northwest. If no changes in water usage are made, and if the Equus Beds are not replenished, the average chloride concentration in the groundwater will increase to levels that will make it unsuitable for drinking or irrigation.

Project Benefits: The ASR project will benefit all water users in the region by:

- Adding up to 70 billion gallons (or 214,000 acre feet) of water to the aquifer to meet the City of Wichita's demands during drought periods.
- Protecting the aquifer from water quality deterioration by creating a hydraulic barrier to stop or halt the intrusion of natural and man made sources of saltwater.
- Reducing power cost for pumping, for both the City and other water users, because of higher groundwater levels.

Remediation Efforts: In 1965, the City began using surface water from Cheney Reservoir to supplement Wichita's public supply. As a result, water use from the Equus Beds aquifer was not as great as it would have been without the availability of water from the reservoir. Groundwater levels did not resume their general decline until the late 1970s to early 1980s when water pumped out from the aquifer for agricultural irrigation and use by the City of Wichita increased.

In 1993 the Wichita City Council adopted an Integrated Local Water Supply Plan that identified cost effective water resources that would be adequate to meet Wichita's water supply needs through the year 2050. In the next 50 years:

- Increases in the population served by the City's water utility will jump from 335,000 to 558,000;
- Increases in the water demand on an average day will go from 62 million gallons per day (mgd) to 125 mgd; and
- Increases in the water demand on peak days will grow 125mgd to 250mgd.

Rather than relying on a single water source, such as a reservoir, the City's plan utilizes a unique variety of water resources. The major components of the plan include greater use of Cheney Reservoir, completing the ASR project, expansion of the local well field adjacent to the Little Arkansas River, development of high chloride water wells adjacent to the Arkansas River and increased water conservation.

THE PROJECT

Demonstration Project: Many of the concepts identified in the City's water supply plan had not been attempted in the past, so the City initiated the Equus Beds Groundwater Recharge Demonstration Project. This project was a small scale $7.2 million, five-year trial project that was used to prove the feasibility of the full-scale $350-$400 million ASR project.

The recharge project represents a unique approach to developing water resources. All of the conventional water rights from the Little Arkansas River, based on minimum desirable flow, have been appropriated. Therefore, the City had to demonstrate that it could capture and use only above base flow water, and acquire a water right for that resource. Such an approach had not been utilized in the past. The project also developed the concept of "bank storage" water, which is water that is temporarily stored in the riverbanks when the flow in the river is higher than normal. By installing a bank storage recovery well, the City successfully demonstrated that it can capture bank storage water and induce water from the river into the banks when the river is high, and thus replace the water pumped from a groundwater well with surface water. The method of capturing and using a water resource has not been utilized in the past.

The pilot project has successfully demonstrated that adequate flow exists in the Little Arkansas River to allow diversion of up to 150 million gallons per day during above base flow events, and that those diversions would only capture 15 percent of the river's flow. In order to ensure that recharging the aquifer with river water would not pollute the aquifer, the project performed an extensive amount of water sampling and analysis. More than 3,300 water samples were collected and analyzed for various contaminates, including salt and atrazine. The testing determined that, while the concentrations of contaminates varied substantially in the river, the water used to recharge the aquifer could be treated so that it always meets drinking water standards.

Another positive aspect of the recharge project is its impact on the Little Arkansas River. The Little Arkansas River is a "gaining" river, which means that water from the Equus Beds aquifer seeps out of the ground and into the river. If water levels in the Equus Beds rise as a result of the recharge project, the aquifer will discharge more water into the river, causing an increase in base flow in the river. Therefore, even though water is being withdrawn from the river during high flow events, the amount of water in the river during low flow periods will be higher, thus improving the river's aquatic environment.

The project has also successfully demonstrated that surface water can be captured and treated to allow it to safely recharge the aquifer through percolation pits, and that pollutants, such as atrazine, can be removed from the water. In addition, the project evaluated the capabilities of recharge wells, recharge pits and recharge trenches to recharge river water, and found that those techniques are, in fact, successful. The demonstration project recharged water from May 1997 through January 2000, successfully storing more than 780 million gallons of water in the aquifer.

Value Proposition

A full-scale recharge project will benefit all stakeholders. The City will benefit by being able to develop a local source of water to meet future water needs of citizens and businesses. Farmers, irrigators, industries and residents in the area will benefit because the water levels in the recharge zone will increase, which lowers their cost to pump. Both the City and the other water users benefit because when the aquifer is raised, the saltwater intrusion from the Arkansas River and the Burton Oil Fields is slowed. The environment also benefits, because this project will cause the low level flows of the river to increase. In addition, this project will benefit other communities who may utilize this project as a resource for finding ways to meet their own future water needs.

Throughout the pilot project, public meetings were held and information was provided to citizens and special interest groups concerned about health and environmental issues regarding the project. The project even included a Web page that was maintained by the U.S. Geological Survey that provided current information on the activities and results of the recharge project (http://ks.water.usgs.gov/studies/equus).

Since the City will only be able to capture river water during above base flow events, it is estimated that it will take 10 to 15 years to recharge the aquifer to the levels required to meet the City's 2020 needs. The City is planning to construct the recharge facilities in phases. The completed first phase, which cost $27 million, has the capacity to recharge up to 10 million gallons per day. The estimated cost of the entire project is $350-$400 million.

All water recharged must be below the Maximum Contaminate Level (MCL) established for drinking water. The only difference between what is being put into the aquifer and what a citizen can obtain directly from the tap is the level of chlorine that is in the tap water. Currently, surface water is being treated to remove atrazine which is a pesticide used by farmers that have runoff into the river water. Samples are currently being tested for 259 different contaminates. All samples to date have tested well below current drinking water standards.

What has been built?
Phase I has a capacity to capture and recharge up to of 10 million gallons per day (MGD). It includes three diversion wells adjacent to the Little Arkansas River, a seven-million-gallon-a-day surface water intake in the Little Arkansas River, a surface water treatment plant, two recharge basins and four recharge wells. The sites for Phase I was selected to allow the start the formation of a hydraulic barrier to the saltwater plume approaching the well field from the Burrton area.

What is next?
Phase II, which consists of 30 million gallons a day of production, is now in the design phase and should be completed by 2012. Phases III and IV will include further expansion of treatment and water-storage capacity.

Applicable Results
Three main components of the ASR project have made it a success.

First: The ASR project required a rapid implementation date. The project was completed as a design/build. Construction of the project began in March 2006 and was ready for operation in September 2006.

Second: The City and contractors had to develop a close working partnership in order to get the project completed on time. Further the effectiveness of the plant and the efficiencies of the technology that were employed required a constant communication stream to ensure that both the City and the contractor were working towards the same goals.

Third: The City had to work very closely with the regulators to ensure that all of the methodologies were not in violation of current standards nor would not they compromise the quality of the project.